conductivity type is set higher beforehand, whereby the adjustment of the charge balance in the case of heat-treating the substrate (**10**) of the first conductivity type can be performed with ease.

[0148] Besides, in the case of adjusting the charge balance, in forming the first layer (**3**) of the second conductivity type, this first layer (**3**) of the second conductivity type should preferably be formed so that the product between the width of the first layer (**3**) of the second conductivity type between the first layers (**2**) of the first conductivity type and the impurity concentration of the first layer (**3**) of the second conductivity type may become larger than the product between the impurity concentration of the substrate (**10**) of the first conductivity type and the width of the first layer (**2**) of the first conductivity type between the first layers (**3**) of the second conductivity type.

[0149] The first layer (**3**) of the second conductivity type is formed so as to satisfy such a condition, whereby the adjustment of the charge balance in the case of heat-treating the substrate (**10**) of the first conductivity type can be easily performed as in the above.

[0150] In preparing the substrate (**10**) of the first conductivity type, a substrate which is doped with phosphorus, arsenic or antimony as an impurity should preferably be prepared as the substrate (**10**) of the first conductivity type.

[0151] Besides, in preparing the substrate (**10**) of the first conductivity type, a substrate whose impurity concentration is at least 1×10^{15} cm^{-3} and at most 1×10^{18} cm^{-3} should preferably be prepared as the substrate (**10**) of the first conductivity type. That is, it is desirable to set the lower limit of a doping quantity at 1×10^{15} cm^{-3} for the purpose of obtaining the substrate doped with the impurity, and to set the upper limit of the doping quantity at 1×10^{18} cm^{-3} for the purpose of avoiding a situation where any depletion layer is not formed.

[0152] As the fifth feature, a substrate (**18**) of first conductivity type which is lower in impurity concentration than a first layer (**2**) of the first conductivity type is prepared, and trenches (**11**) are formed on the front surface side of the substrate (**18**) of the first conductivity type. In addition, inner wall surfaces of the trenches (**11**) are subjected to vapor phase diffusion or ion implantation, whereby the wall surfaces of the trenches (**11**) are formed into the first layer (**2**) of the first conductivity type. Thereafter, a first layer (**3**) of second conductivity type is formed on the first layer (**2**) of the first conductivity type, thereby to form a structure in which the first layer (**2**) of the first conductivity type and the first layer (**3**) of the second conductivity type are repeatedly arranged. The rear surface side of the substrate (**18**) of the first conductivity type formed with the repeated structure is thinned, thereby to form a second layer (**1**) of the first conductivity type on the rear surface side.

[0153] In this manner, in manufacturing a semiconductor device, the substrate (**18**) of the first conductivity type is first prepared. Thus, as stated before, epitaxial films for the repeated structure need not be formed beforehand. Besides, owing to the use of the substrate (**18**) of the first conductivity type, the semiconductor device in which the terminal end part of a chip is considered can be manufactured.

[0154] As the sixth feature, regarding the fifth feature, the first layer (**2**) of the first conductivity type is epitaxially grown on the inner wall surfaces of the trenches (**11**) formed on the front surface side of the substrate (**18**) of the first conductivity type, and the first layer (**3**) of the second conductivity type is epitaxially grown on the first layer (**2**) of the first conductivity type.

[0155] In this manner, the first layer (**2**) of the first conductivity type and the first layer (**3**) of the second conductivity type may well be respectively formed by the epitaxial growths. Thus, the widths of the first layer (**2**) of the first conductivity type and the first layer (**3**) of the second conductivity type can be made small, and ion resistances in the respective layers can be lowered.

[0156] As the seventh feature, regarding the fifth feature, oxide films (**13**) are formed on the first layer (**3**) of the second conductivity type, thereby to fill up the trenches (**11**) with the oxide films (**13**). In this manner, the structure in which the trenches (**11**) are filled up with the oxide films (**13**) can also be formed.

[0157] In the case of manufacturing the semiconductor device by employing the substrate (**18**) of the first conductivity type as stated above, the substrate (**18**) of the first conductivity type is prepared, and N-channel type semiconductor elements of vertical type are thereafter formed at the front surface layer part of the substrate (**18**) of the first conductivity type, whereupon the trench (**11**) can be formed between the N-channel type semiconductor elements of the vertical type, in the substrate (**18**) of the first conductivity type.

[0158] In the case of manufacturing the semiconductor device by employing the substrate (**18**) of the first conductivity type, before a second layer (**1**) of the first conductivity type is formed on the rear surface side of the substrate (**18**), the N-channel type semiconductor element of the vertical type can also be formed at the front surface layer parts of the first layer (**2**) of the first conductivity type constituting the repeated structure and a third layer (**15**) of the first conductivity type held between the first layers (**2**) of the first conductivity type.

[0159] Incidentally, the bracketed numerals of the various means indicate corresponding relations with concrete means which will be stated in embodiments to be described later.

[0160] While the invention has been described with reference to preferred embodiments thereof, it is to be understood that the invention is not limited to the preferred embodiments and constructions. The invention is intended to cover various modification and equivalent arrangements. In addition, while the various combinations and configurations, which are preferred, other combinations and configurations, including more, less or only a single element, are also within the spirit and scope of the invention.

What is claimed is:

1. A method for manufacturing a semiconductor device comprising:

forming a plurality of trenches on a first side of a semiconductor substrate, wherein the substrate has a first conductive type;

forming a second conductive type semiconductor film in each trench so that the substrate between two adjacent trenches provides a first column, and the second conductive type semiconductor film in each trench provides a second column, wherein the first and second columns are alternately repeated along with a predetermined direction in parallel to the first side of the substrate;

thinning a second side of the substrate, the second side being opposite to the first side; and